Atty. Dkt. No. 017447-0194

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Koichi WATANABE et al.
Title:	SPUTTERING TARGET AND PROCESS FOR PRODUCING Si OXIDE FILM THEREWITH
Appl. No.:	10/573,406
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Examiner:	Jason Berman
Art Unit:	1795
Confirmation Number:	2973

PRE-APPEAL BRIEF REQUEST FOR REVIEW

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Sir:

In accordance with the **Pre-Appeal Brief Conference Pilot Program**, announced July 11, 2005, this Pre-Appeal Brief Request is being filed together with a Notice of Appeal.

REMARKS

Rejection under 35 U.S.C. § 103

Claims 1, 3, 10, 11, and 14 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 4,416,755 to Ceasar *et al.* (hereafter "Ceasar") in view of U.S. Patent No. 6,197,134 to Kanzaki *et al.* (hereafter "Kanzaki") and 6,800,182 to Mitsui *et al.* (hereafter "Mitsui"). This rejection is respectfully traversed.

Ceasar discloses a method and apparatus for coating a substrate with a semiconducting material and discloses an example of a target that includes high purity,

undoped polycrystalline silicon. See Ceasar at col. 1, lines 13-16, and col. 8, lines 31-34. The Office states on page 3 of the Office Action that Ceasar does not disclose or suggest crystal orientation ratios, such as those recited in claim 1. Claims 3, 10, 11, and 14 depend from claim 1.

Kanzaki discloses that face-centered cubic metals suitable for use as target materials can have orientations satisfying the relation $I_{(220)}/ I_{(111)} \leq 1.0$, with $I_{(220)}$ representing the intensity of the (220) face and $I_{(111)}$ representing the intensity of the (111) face. See Kanzaki at col. 1, lines 8-10, and col. 2, lines 9-18. However, Ceasar and Kanzaki are silent in regard to relative density of a target. Therefore, the combination of Ceasar and Kanzaki does not render claims 1, 3, 10, 11, and 14 to be unpatentable because the combination of Ceasar and Kanzaki does not disclose or suggest a sputtering target consisting essentially of, among other things, Si, wherein the target comprises Si sintered material having a relative density in a range of 70% or more and 95% or less, as recited in claim 1.

Mitsui discloses a sputtering target that comprises SiC and metallic Si. See Mitsui at col. 1, lines 64-67. The Office argues on page 3 of the Office Action that it would have been obvious to modify the target of Ceasar and Kanzaki "to form a target with a relative density of 80%, as disclosed by Mitsui."

The Office argues on page 5 of the Office Action that Mitsui is relied upon for its disclosure of "Si containing targets" but "Mitsui is not relied upon for its disclosure of a specific target composition." However, as noted on page 3 of the Office Action, the Office clearly relies upon Mitsui to provide a teaching of relative density with its argument to modify the target of Ceasar and Kanzaki "to form a target with a relative density of 80%, as disclosed by Mitsui."

The Office cites claim 12; col. 5, line 48; col. 4, lines 50-52; and the abstract of Mitsui in support of its argument. The abstract of Mitsui states that a sputtering target includes SiC and metallic Si but is silent in regard to the relative density of the target. Col. 4, lines 50-52, of Mitsui is silent in regard to the relative density of a sputtering target. The Office further cites col. 2, lines 59-61, 52-54, in the Advisory Action. However, these lines also regard a

target that "comprises SiC and metallic Si" and contrasts such a target to a Si target by stating "as compared with conventional Si targets, the film-forming speed can be made large per unit applied electric power." In other words, Mitsui itself shows that there is a difference between a target consisting essentially of Si, as recited in claim 1, and the target disclosed by Mitsui.

Further, claim 12 of Mitsui recites a target, according to claim 1 of Mitsui, that has a relative density of at least 60%. However, claim 1, which claim 12 depends from, provides a target that comprises SiC and metallic Si. Thus, similarly to the passage of col. 2 of Mitsui, the relative density recited and disclosed in claim 12 is not a relative density for a sputtering target consisting essentially of Si, as recited in claim 1, and is not applicable to such a sputtering target because a sputtering target comprising SiC and metallic Si is different from a sputtering target consisting essentially of Si, as recited in claim 1.

In col. 5, line 39, to col. 6, line 41, Mitsui discloses an example in which SiC powder is sintered to provide a SiC preform that has a relative density of about 81%. See Mitsui at col. 5, lines 39-48.

However, this is a preform made of SiC and does not consist essentially of Si, as recited in claim 1. Nor is this a sputtering target because Mitsui specifically states in col. 5, lines 48-51, that the "sintered product was immersed in metallic Si melted at 1600°C. in vacuo to have metallic Si impregnated to obtain a target comprising SiC and metallic Si as the main components" (emphasis added). Mitsui discloses other targets in its comparative examples, such as a Si target in example 2 of Mitsui, which is a comparative example, but Mitsui teaches against such a target due its poor performance due to cracking, unstable discharge, and need for use of low power.

In other words, the Office relies upon the teachings of Mitsui to provide the feature of a relative density but the teaching of Mitsui is for a preform, not a target, because Mitsui discloses that a target is provided only once metallic Si has been impregnated into the preform. However, the target provided by Mitsui comprises SiC and metallic Si and is not a sputtering target consisting essentially of Si, as recited in claim 1. The arguments by the Office have considered the teachings of Mitsui in piecemeal by focusing solely on Mitsui's

disclosure of a relative density without considering what object the relative density of Mitsui represents, which is not a sputtering target consisting essentially of Si, as recited in claim 1. The teachings of Mitsui simply do not factually support the Office's conclusion that it would have been obvious to provide a sputtering target consisting essentially of Si with the relative density recited in claim 1. The Office argues in the Advisory Action that although the teachings of Mitsui do not apply to a target that consists essentially of Si, as recited in claim 1, it would have been obvious to apply the teachings of Mitsui to other targets, such as the target of Ceasar. However, the Office does not provide any evidence or technical reasoning to support this argument of obviousness, which is understandable because one of ordinary skill in the art would not have found such a modification to be obvious.

In fact, one of ordinary skill in the art would understand that a target comprising SiC and Si has different characteristics than a Si target. Mitsui discusses silicon targets and notes that they have relatively low film-forming speeds and are susceptible to cracking. See Mitsui at col. 1, lines 16-43. In contrast, Mitsui states that the SiC and Si target of Mitsui provides a high film-forming speed and suppresses cracking. See Mitsui at col. 1, lines 55-61, and col. 2, lines 4-34. As a result, the SiC and Si target of Mitsui is not a target consisting essentially of Si, as recited in claim 1, because a SiC and Si target affects the basic and novel characteristics of a Si target, as disclosed by Mitsui. One of ordinary skill in the art would not have looked to the teachings of Mitsui when considering a modification to a Si target due to these differences between a Si target and a target comprising SiC and Si.

Therefore, Mitsui does not remedy the deficiencies of Ceasar and Kanzaki because Mitsui also does not disclose or suggest a sputtering target consisting essentially of, among other things, Si, wherein the target comprises Si sintered material having a relative density in a range of 70% or more and 95% or less, as recited in claim 1. Instead, Mitsui discloses only relative densities for targets comprising SiC and Si and for SiC preforms, which have not yet been made into sputtering targets.

As discussed in paragraphs 0024-0027 of Applicant's specification, a relative density of 70% to 95% and a sputtering surface having a ratio ($I_{(111)}/I_{(220)}$) of peak intensity ($I_{(111)}$) of (111) face to peak intensity ($I_{(220)}$) of (220) face of Si is in a range of 1.8 ± 0.3 advantageously

provides a Si target with an improved film forming speed, with the relative density not exceeding 95% because higher densities correlate to orientations in particular crystal plans, and the relative density not being less than 70% to provide a target with a sufficient strength.

The Office argues on page 4 of the Office Action that the teachings of Kanzaki could be applied to silicon because it is an fcc material. However, the teachings of Kanzaki regard an fcc metal target formed by a melting process, not a target comprising Si sintered material, as recited in claim 1. In other words, Kanzaki does not disclose or suggest controlling the crystal face of an fcc metal target that is a sintered material, as recited in claim 1.

In addition, the examples of Kanzaki regard copper materials, not silicon. Kanzaki does not disclose or suggest controlling the $(I_{(111)}/I_{(220)})$ intensity ratio for silicon. Applicant notes that the sputtering conditions for a silicon target differs from those for a copper target, particularly since silicon has an atomic weight (28.1) that is significantly different from that of copper (63.5). Therefore, Kanzaki does not disclose or suggest that a silicon target has a ratio $(I_{(111)}/I_{(220)})$ of peak intensity $(I_{(111)})$ of (111) face to peak intensity $(I_{(220)})$ of (220) face of Si is in a range of 1.8 ± 0.3, as recited in claim 1, and does not remedy the deficiencies of Ceasar.

CONCLUSION

In view of the foregoing, it is respectfully submitted that a clear error has been made and the application is in condition for allowance.

Respectfully submitted,

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